Storm Protection Services of Mangrove Forests

Jacob Hochard*, Stu Hamilton! & Edward Barbier%

2016 Social Coast Forum

Charleston, South Carolina

* East Carolina University
! Salisbury University
% University of Wyoming

Research Questions:

Research Questions:

- Do tropical cyclones influence economic growth?

Research Questions:

- Do tropical cyclones influence economic growth?
- Does frequency of exposure matter?

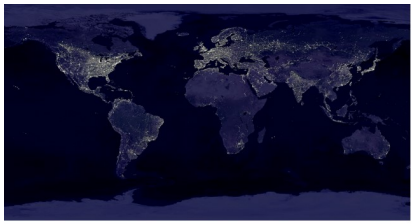
Research Questions:

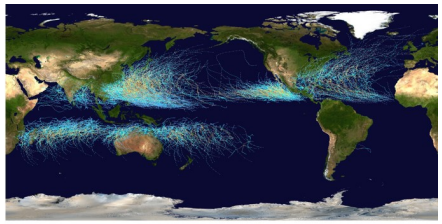
- Do tropical cyclones influence economic growth?
- Does frequency of exposure matter?
- Are cyclone-prone areas better adapted to cyclone exposure?

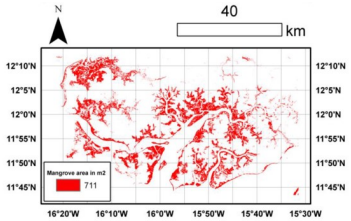
Research Questions:

- Do tropical cyclones influence economic growth?
- Does frequency of exposure matter?
- Are cyclone-prone areas better adapted to cyclone exposure?
- Do mangrove forests insulate economic growth from exposure?

Datasets

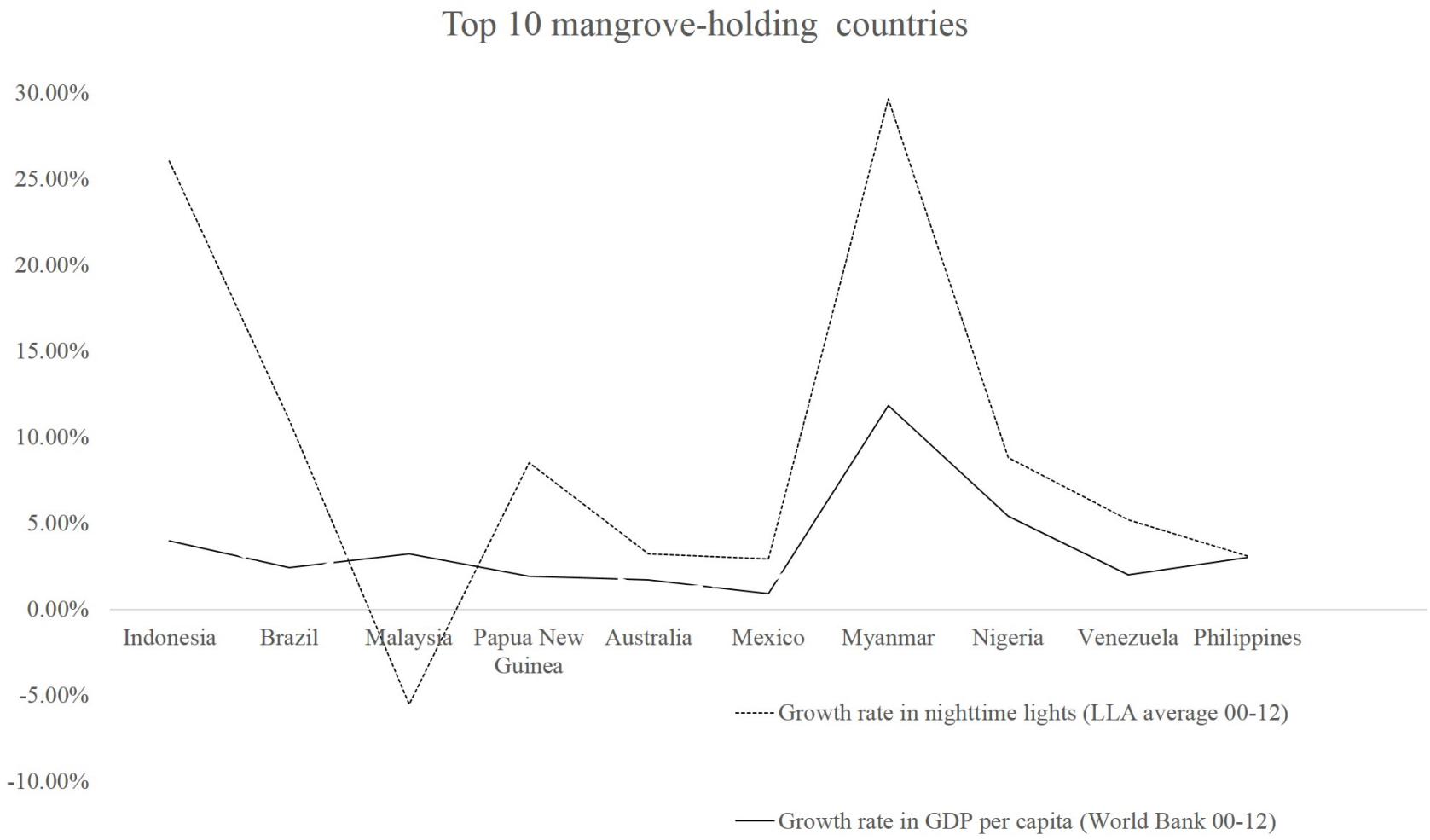




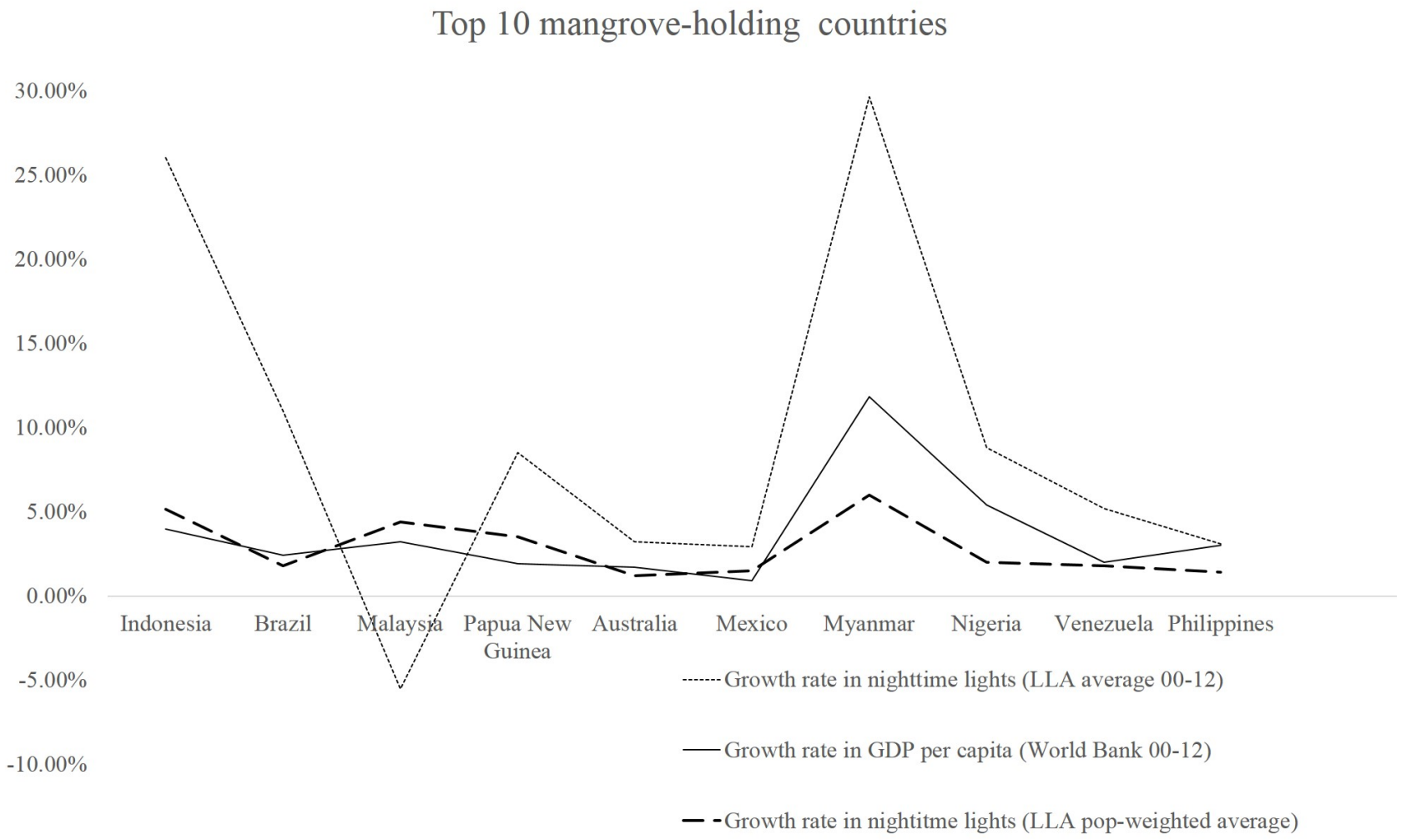


- 81 countries - 7,296 lowest administrative units (LLAs) globally
- 791 historical cyclone paths (85-12)
- LandScan population data (00-12)
- NOAA nighttime lights (00-12)
- World Bank Development Indicators (00-12)
- Global high resolution mangrove forest cover (00-12)

Predicting LLA-level economic growth



Predicting LLA-level economic growth



Predicting LLA-level economic growth

Country calibration:

$$\Delta GDP^{pc}_{c,t} = \alpha_0 + \alpha_1 \overbrace{\sum_{i=1}^{N} \left(\frac{P_{i,c,t}}{\sum_{i=1}^{N} P_{i,c,t}} \right)}^{\text{Village-level population weighting}} (\Delta L_{i,c,t}) + \gamma_c + \delta_t + \epsilon_{c,t}$$

Village prediction:

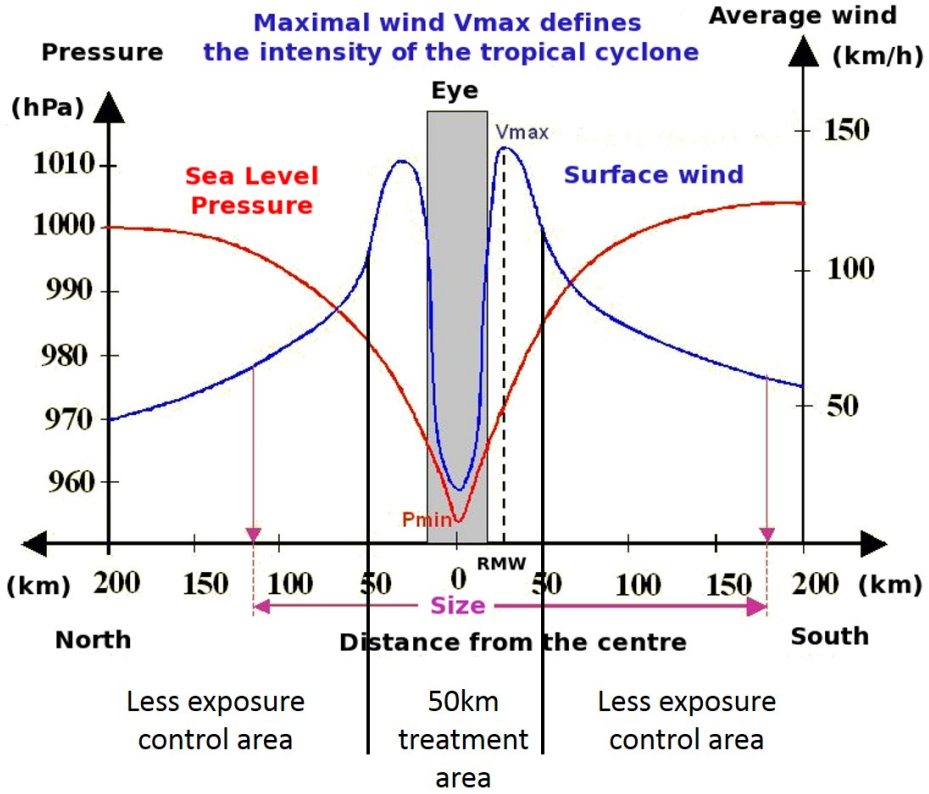
$$\Delta \hat{GDP}^{pc}{}_{i,c,t} = \hat{\alpha_0} + \hat{\alpha_1}(\Delta L_{i,t}) + \hat{\gamma_c} + \hat{\delta_t} + \epsilon_{i,c,t}$$

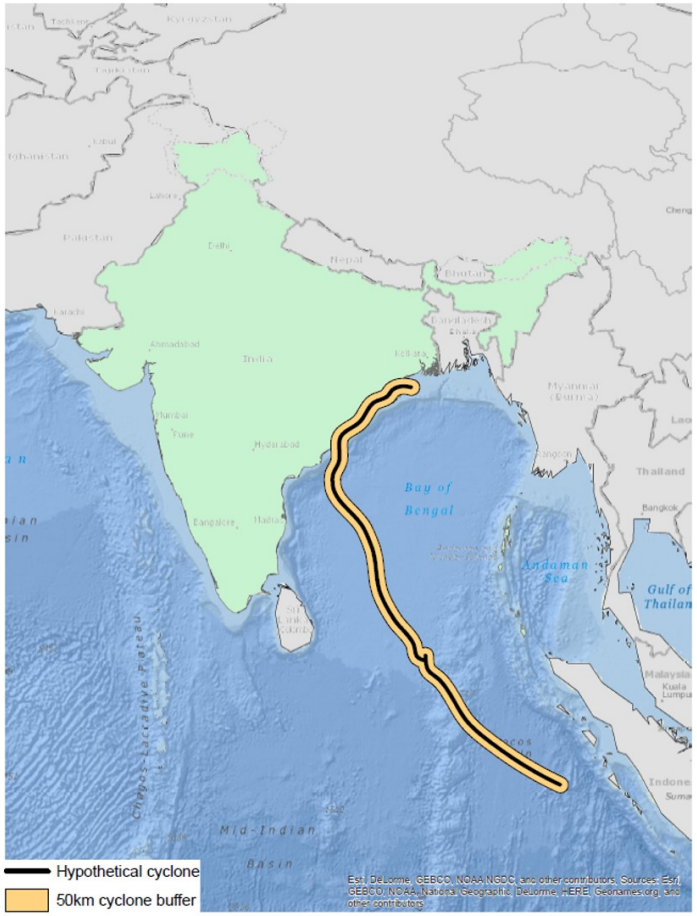
- $\Delta GDP^{pc}_{c,t}$ = Change in GDP per capita
- $\Delta L_{i,t}$ = Change in nightime lights
- i = village
- c = country
- t = year
- α_1 = lights to growth calibration parameter
- γ_c, δ_t = year and country aggregation restrictions

Methods:

Autoregressive distributed lag (ADL) model ($n = 4$)

$$ln(GDP^{pc}_{i,p,t}) - ln(GDP^{pc}_{i,p,t-1}) = \sum_{i=0}^{n}(\beta_i C_{i,t-L}) + \gamma_p + \tau_t + \alpha X_{i,t} + \epsilon_{i,t}$$



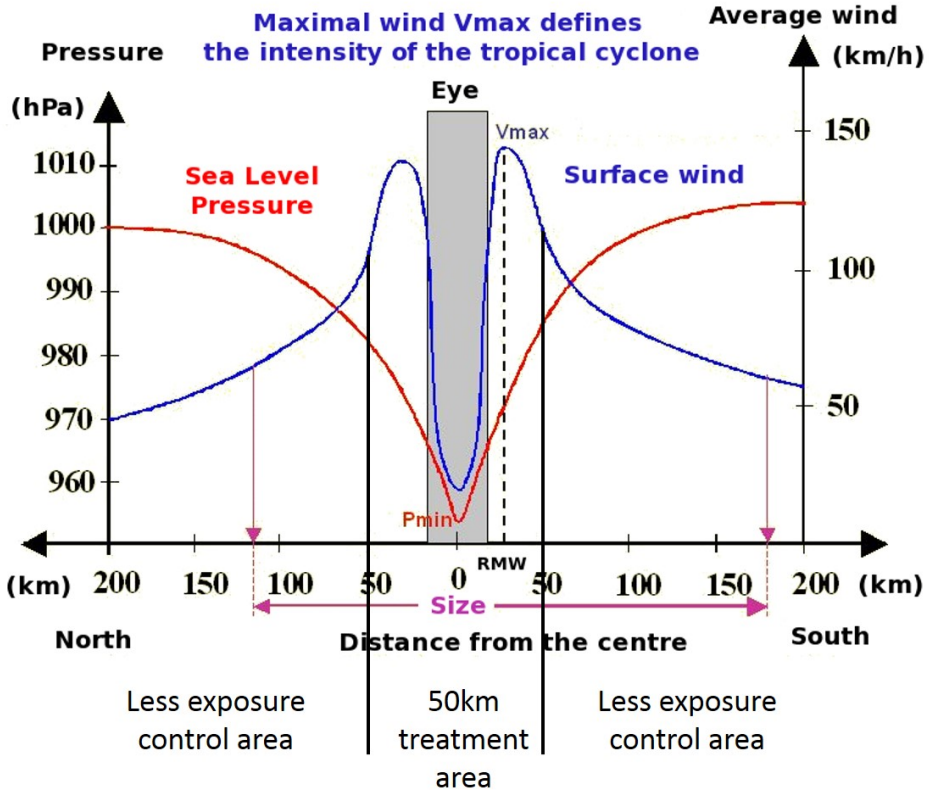


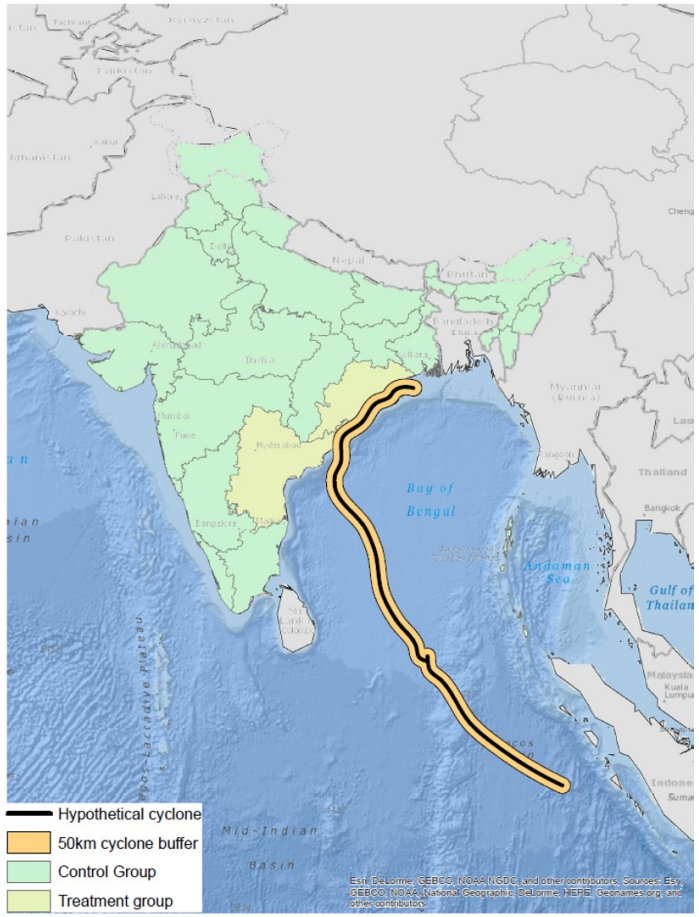
Adapted from meteo france

Methodological approach:

Autoregressive distributed lag (ADL) model

$$ln(GDP^{pc}_{i,p,t}) - ln(GDP^{pc}_{i,p,t-1}) = \sum_{i=0}^{n}(\beta_i C_{i,t-L}) + \gamma_p + \tau_t + \alpha X_{i,t} + \epsilon_{i,t}$$



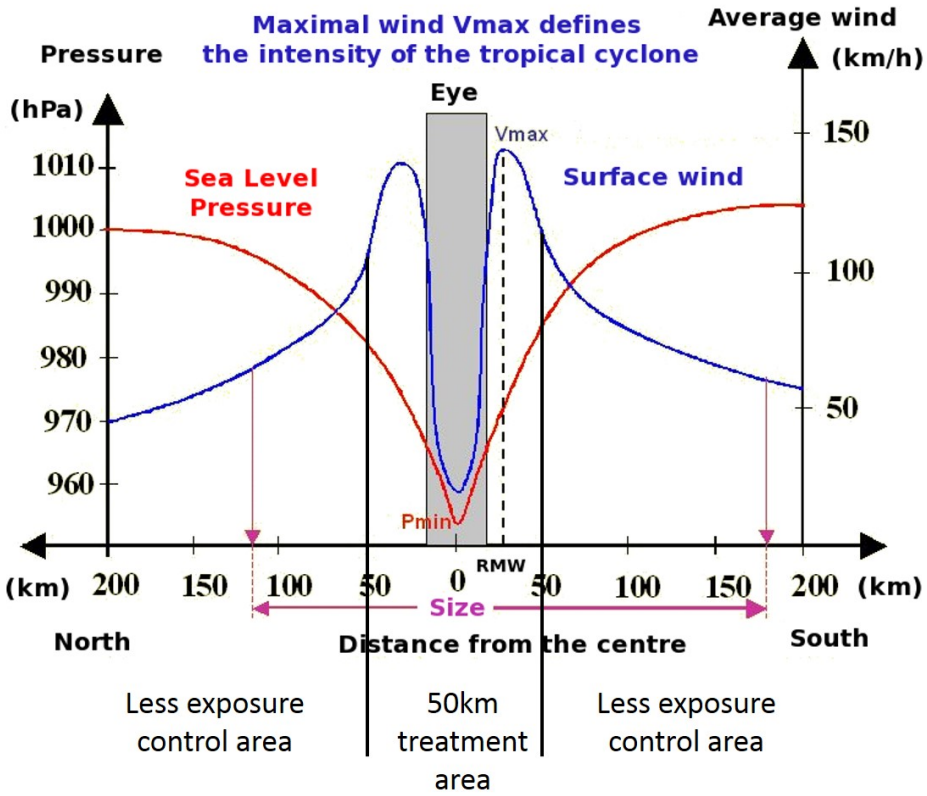


Adapted from meteo france

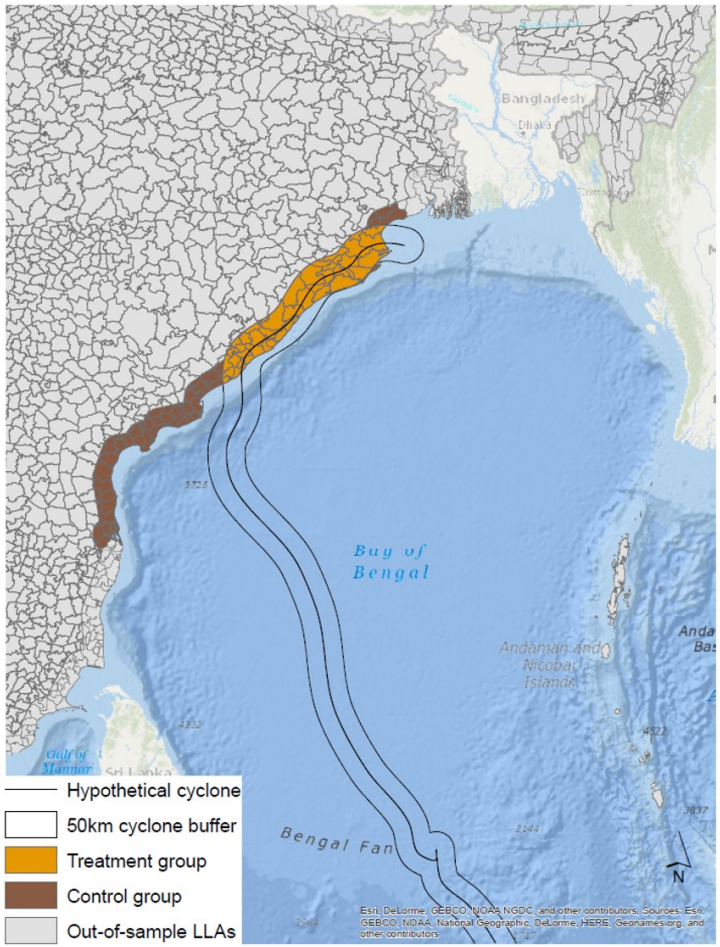
Methods:

Autoregressive distributed lag (ADL) model

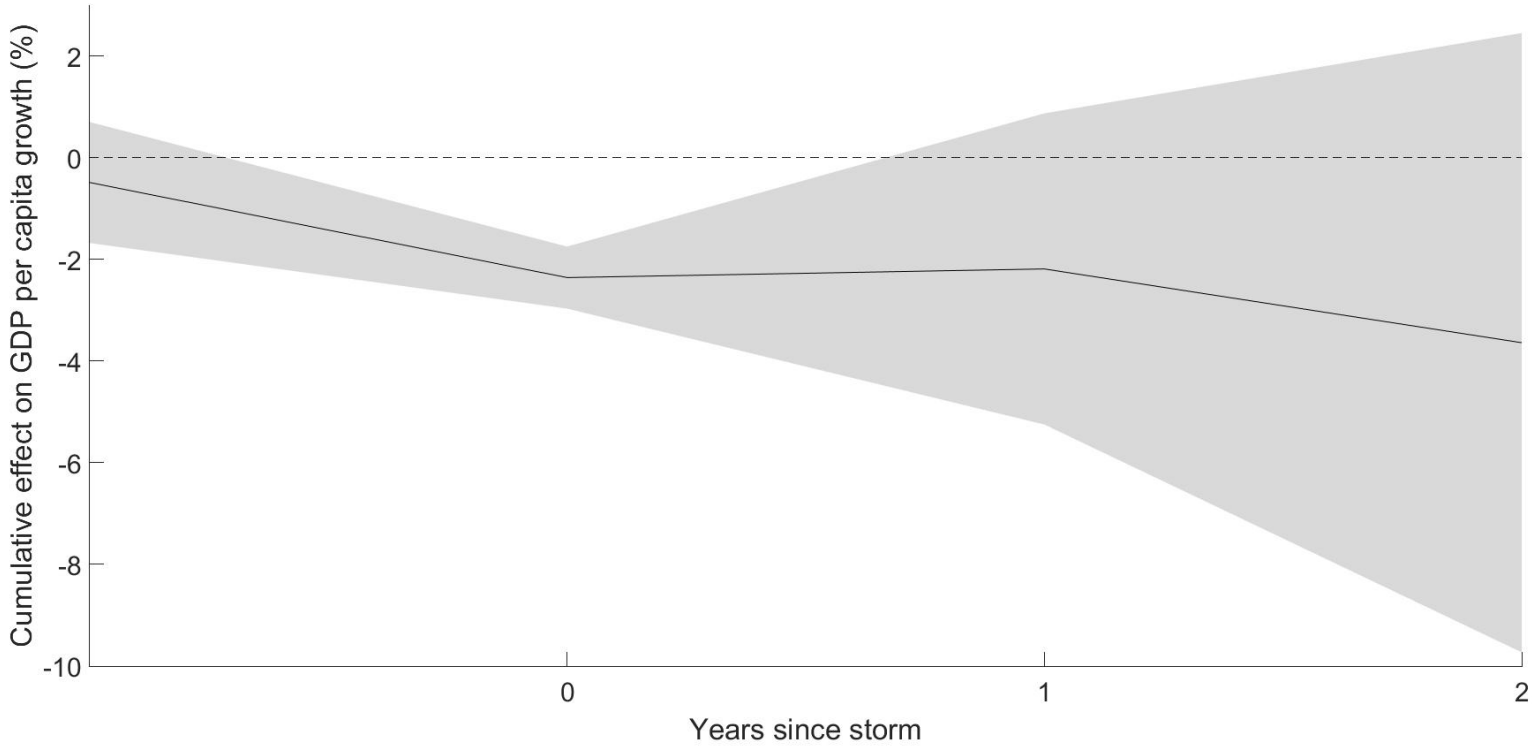
$$ln(GDP^{pc}_{i,p,t}) - ln(GDP^{pc}_{i,p,t-1}) = \sum_{i=0}^{n}(\beta_i C_{i,t-L}) + \gamma_p + \tau_t + \alpha X_{i,t} + \epsilon_{i,t}$$



Adapted from meteo france

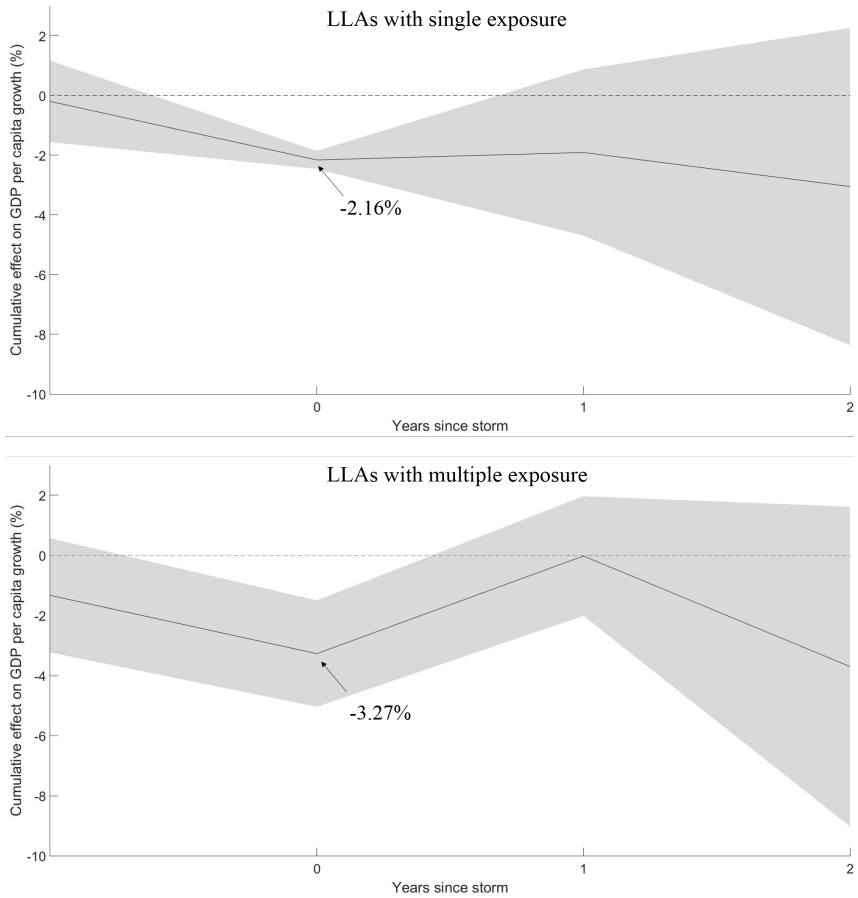


Results: Do tropical cyclones influence economic growth?



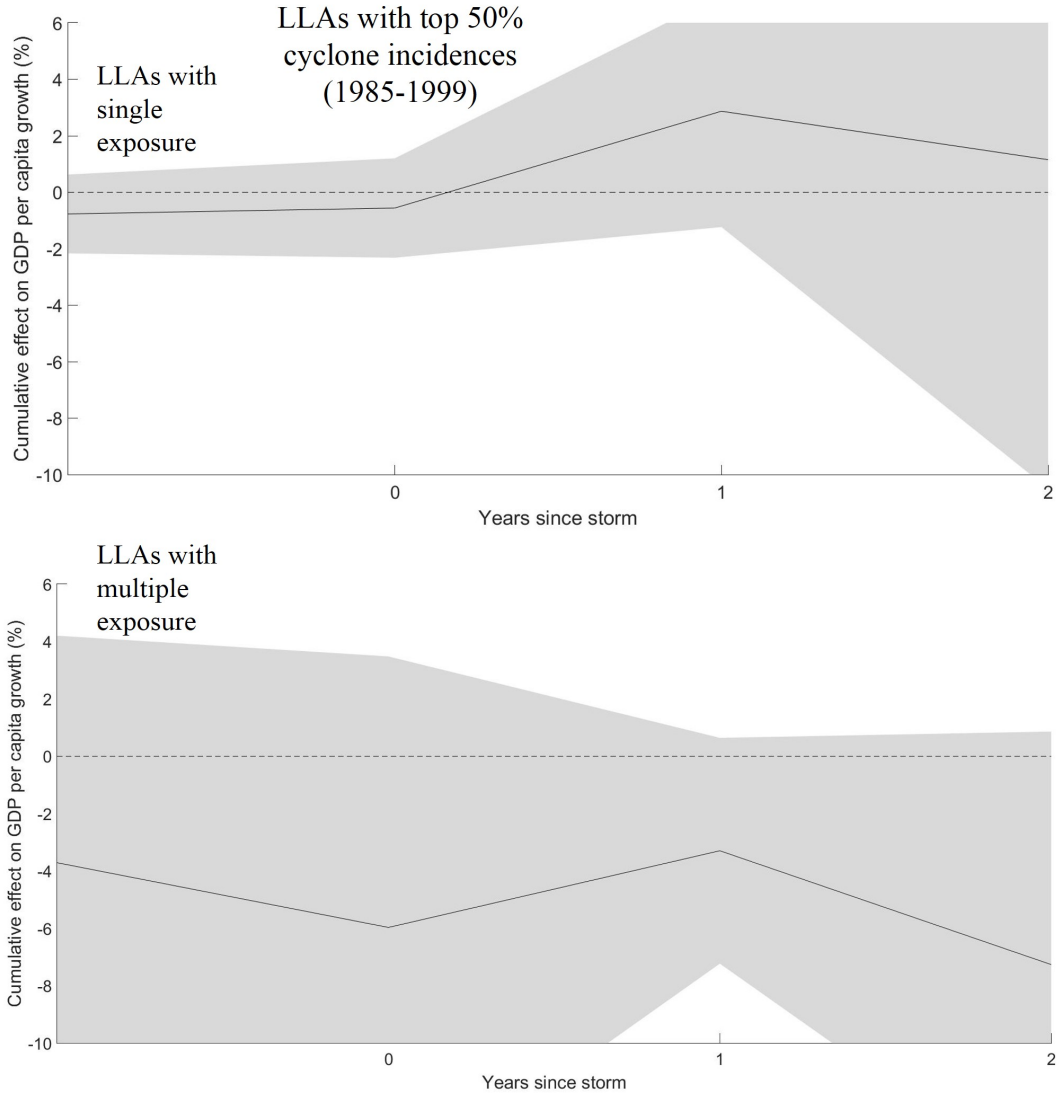
- Panel from 2000-2012, 7,298 LLAs, AR(4).
- 50km exposure buffer.
- Standard errors clustered at hurricane basin level.
- Year, province & country-year fixed effects.
- Sample includes only those LLAs within 50km of coastline.

Results: Does frequency of exposure matter?

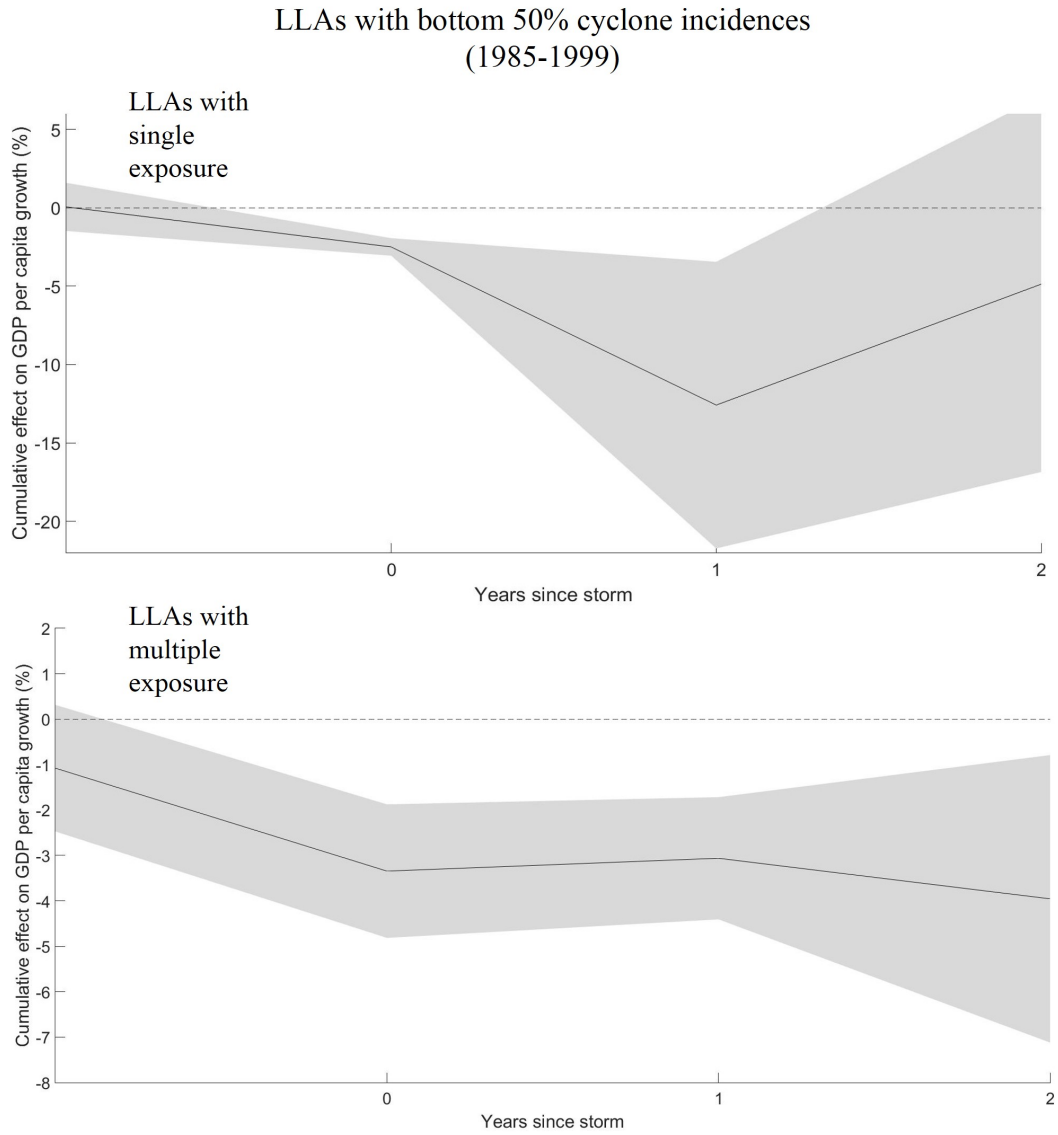


- Panel from 2000-2012, 7,298 LLAs, AR(4).
- 50km exposure buffer.
- Standard errors clustered at hurricane basin level.
- Year, province & country-year fixed effects.
- Sample includes only those LLAs within 50km of coastline.

Result: Are cyclone-prone areas better adapted to cyclone exposure?



Result: Are cyclone-prone areas better adapted to cyclone exposure?



Result: Do mangrove forests insulate economic growth from cyclone exposure?